REMARKS

In response to the Official Action mailed on April 5, 2005, the application has been amended. No new matter has been added. Reconsideration of the rejections of the claims is respectfully requested in view of the above amendments and the following remarks.

On page 2 of the Official Action, claims 1, 2, 4, 5, 7 - 10, 19, 21 - 24, and 26 were rejected under 35 USC 102(b) as anticipated by Steitz (U.S. Patent No. 3,719,981). This rejection is respectfully traversed.

Amended claim 1 describes a solder ball assembly including a covering sheet spaced from an adherent layer for covering solder balls in a heat-resisting sheet. Amended claim 1 is supported by Figure 4 and by page 16 of the application as filed. Steitz does not disclose or suggest such an arrangement.

Steitz discloses a method of joining solder balls to solder bumps. In one stage of the method, as shown in Figures 1 - 4 of Steitz, solder balls 26 are placed in holes in a metal mask 22 sitting atop pressure sensitive tape 18 having a tacky surface 20. In another stage of the method, as shown in Figure 9, the solder balls 26 are positioned in openings 30 in another mask 28 atop solder bumps 12, and the tape 18 covers the solder balls 26 in the mask 28. Page 3 of the Official Action states that Figure 9 of Steitz discloses a covering placed atop a heat-resisting sheet to cover solder balls in holes. The Official Action does not identify the covering by part number, but it is assumed that

the Official Action is referring to the backing of pressure sensitive tape 18 as being a covering. However, the backing of tape 18 does not correspond to the covering sheet of claim 1, since claim 1 states that the covering sheet is spaced from an adherent layer, and since it appears that the Official Action considers the tacky surface 20 of tape 18 to be an adherent layer, the backing of tape 18, which not only adjoins the tacky surface 20 but forms a single member with it, is clearly not a covering sheet spaced from an adherent layer as set forth in claim 1.

Thus, as Steitz does not disclose a covering sheet as set forth in claim 1, it does not disclose all the features of claim 1 and so cannot anticipate it or claims 2, 4, 5, 7 - 9, or 22 - 24 which depend from claim 1. These claims are therefore allowable. The features of claims 10 and 21 have been incorporated into claim 1, so these claims have been cancelled as unneeded. Claims 19 and 26 have been cancelled to reduce claim fees, so the rejection of these claims is now moot.

On page 4 of the Official Action, claims 3, 20, and 25 were rejected under 35 USC 103(a) as unpatentable over Steitz in view of Endo (JP 11-297769). This rejection is respectfully traversed because there is no motivation to be found in the references to combine them in the manner proposed by the Official Action.

As stated above, Steitz discloses a method of joining solder balls to solder bumps using first and second masks 22 and 28 which are used to position solder balls 26 either atop a tape 18

or atop solder bumps 12 on a semiconductor wafer 2.

Endo discloses a method of manufacturing a BGA wiring tape which enables holes in the tape which increase in diameter towards the die side of the tape (holes like those shown in Figure 5 of Endo) to be formed by punching. As shown in Figure 1 of Endo, during a punching process, a cover film 12 is placed atop an adhesive 6 on the top surface of a tape substrate 5a, and a soft dummy sheet 13 is placed on the bottom side of the tape substrate 5a. After the completion of punching, the cover film 12 is peeled off (paragraph 0012 of Endo), and since there is no attachment between the dummy sheet 13 and the tape substrate 5a, the dummy sheet 13 is also presumably removed. The punched tape is then used to form a BGA package in the manner shown in Figure 4 of Endo.

With respect to claim 3, page 4 of the Official Action states that it would have been obvious from Endo to have modified the arrangement of Steitz to have an adherent layer exposed to the interior of a hole on a wall of the hole "for better ball gripping". However, Endo provides no support for this assertion. There is no statement anywhere in the text of Endo that having an adherent layer exposed to the interior of a hole on a wall of the hole provides "better ball gripping". Furthermore, when the wiring tape of Endo is actually used to hold solder balls, the adhesive 6 is neither within a sheet nor exposed to the interior of a hole on a wall of the hole. As shown in Figure 4 of Endo, the adhesive 6 sits atop the tape substrate 5a and is not inside a sheet at all. Thus, there is no teaching in Endo that would

suggest to a person skilled in the art to modify Steitz to have an adherent layer exposed to the interior of a hole on a wall of the hole.

With regard to claim 20 (the features of which have been incorporated into claim 1), page 4 of the Official Action states that Figure 1 of Endo shows first and second heat-resisting layers (elements 13 and 6 according to the Official Action) sandwiching an adherent layer (element 5a according to the Official Action), and that it would have been obvious from Endo to modify Steitz to use first and second heat-resisting layers "to delay cracking of the layers". Whether or not the various layers 5a, 6, and 13 of Endo pointed out by the Official Action are in fact heat-resisting layers (Endo is silent about heat resistance), the multi-layer structure shown in Figure 1 of Endo is not a configuration which could ever exist in Steitz. As stated above, the multi-layer structure shown in Figure 1 of Endo comprising tape substrate 5a, adhesive 6, cover film 12, and dummy sheet 13 is a temporary configuration which is employed during the process of punching holes in the tape substrate 5a. After punching, both the cover sheet 12 and the dummy sheet 13 are removed from the tape substrate 5a and the adhesive 6, and when the tape substrate 5a is attached to solder balls 4 as shown in Figure 3 to form a BGA package, the cover sheet 12 and the dummy sheet 13 are absent, so there are no first and second heat-resisting layers sandwiching an adhesive layer when the tape of Endo is actually used to hold solder balls. Since the state in

which the adhesive 6 in Endo is disposed between two layers is a state that could never exist in Steitz (since it does not exist in the presence of solder balls), a person skilled in the art would receive no motivation from Endo to modify Steitz to have an adhesive layer sandwiched between two heat-resisting layers.

Thus, as there is no motivation in Steitz or Endo to combine them in the manner proposed by the Official Action, the grounds of rejection do not set forth a *prima facie* case of obviousness. Claim 3 is therefore allowable. Claim 25, which depends from claim 19, has been cancelled along with claim 19 to reduce claim fees, so its rejection is now moot. The features of claim 20 have been incorporated into claim 1, so claim 20 has been cancelled as unneeded.

On page 6 of the Official Action, claim 6 was rejected under 35 USC 103(a) as unpatentable over Steitz in view of Ochiai et al (U.S. Patent No. 6,319,810, referred to below as Ochiai). This rejection is respectfully traversed because the references provide no motivation to combine them in the manner proposed by the Official Action.

As described above, Steitz discloses a method of joining solder balls to solder bumps in which first and second masks 22 and 28 are used to position solder balls 26. The holes formed in the masks for receiving solder balls 26 have a constant diameter.

Ochiai discloses a method of forming solder bumps in which holes 12 in a flat plate 10 are filled with solder paste 14, and the solder paste is melted to form solder balls 22. In the

embodiments of Figures 1, 3, and 4 of Ochiai, the solder paste 14 is melted while contacting electrode pads 20 on an electric component 18 so that the solder balls are formed directly on the electrode pads 20. In the embodiment of Figure 5 of Ochiai, the solder paste 14 is first melted to form solder balls 22, and then the resulting solder balls 22 are transferred to atop electrode pads 18.

In the embodiments of Figures 1, 3, and 5, a flat plate 10 in which solder paste 14 is melted to form the paste 14 into solder balls 22 has holes 12 with a tapered cross section. According to page 5 of the Official Action, it would have been obvious from Ochiai to have modified Steitz to have used tapered holes in the mask 22 or 28 "in order to produce multiple holes of identical size and shape". Ochiai provides no support for this assertion. There is no disclosure in Ochiai that the use of tapered holes has any connection with producing holes of identical size and shape. Column 5, lines 31 - 34, a passage mentioned by the Examiner, states that small holes having an identical size can be formed in a silicon plate by anisotropic etching. Ochiai says nothing about tapered holes being either needed or having any particular effect. The reason why the holes 12 in the plate 10 of Ochiai are tapered is presumably because the holes 12 are being used to form a solder paste 14 into solder balls 22, and in plates used for this purpose, it is common for holes or recesses in the plates to have sloping walls. A person skilled in the art could find no suggestion in Ochiai that the use of tapered holes has any advantage, and particularly not in a

situation not involving the formation of solder balls from a solder paste.

In contrast to the plate 10 of Ochiai, the masks 22 and 28 employed in Steitz are for the purpose of positioning previously-manufactured solder balls in a prescribed pattern. Ochiai does not disclose holes for this purpose, so it naturally does not disclose anything about the suitable shape of holes for this purpose. Since the holes 12 in the plates 10 of Ochiai have a completely different function from the holes in the masks 22 and 28 of Steitz, a person skilled in the art could find no teaching in Ochiai concerning the shape of the holes in a mask like the masks 22 and 28 employed in Steitz that would motivate him to modify the shapes of the holes in the masks 22 and 28.

Thus, as there is no motivation in the references to modify Steitz in the manner proposed by the Official Action, the grounds of rejection fail to set forth a *prima facie* case of obviousness and as such are unreasonable. Claim 6 is therefore allowable.

New claims 27 - 29 describe additional features of the present invention. Claim 27 is allowable as depending from claim 1. New claim 28 describes a solder ball assembly having solder balls projecting from a hole on the bottom side of a heat-resisting sheet. Claim 28 describes the solder ball assembly in a state in which it has been inverted prior to being placed on a substrate, as described, for example, on page 19, line 19 of the application as filed. Figure 9 of Steitz shows a configuration in which solder balls 26 project above the top surface of a mask

28, but there is no disclosure or suggestion in Steitz of solder balls protruding from the bottom surface of a heat-resisting sheet as set forth in claim 28. New claim 29 describes a solder ball assembly having an adherent layer spaced from the bottom side of a heat-resisting sheet and supporting the entire weight of solder balls disposed in holes in the sheet. Claim 29 also describes a state of the solder ball assembly in which it has been inverted prior to being placed on a substrate. In the configuration of Figure 4 of Steitz, solder balls 26 sit atop a tape 18 disposed beneath a mask 22. In the configuration shown in Figure 9 of Steitz, solder balls 26 sit atop solder bumps 12 on a semiconductor wafer 2. There is no configuration in Steitz in which the solder balls 26 have their entire weight supported by an adherent layer spaced from the bottom side of a heat-resisting sheet as set forth in claim 29. Claims 28 and 29 are accordingly allowable.

In light of the foregoing remarks, it is believed that the

present application is in condition for allowance. Favorable consideration is respectfully requested.

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